Vol. IV No. 2

BULLETIN

OF THE

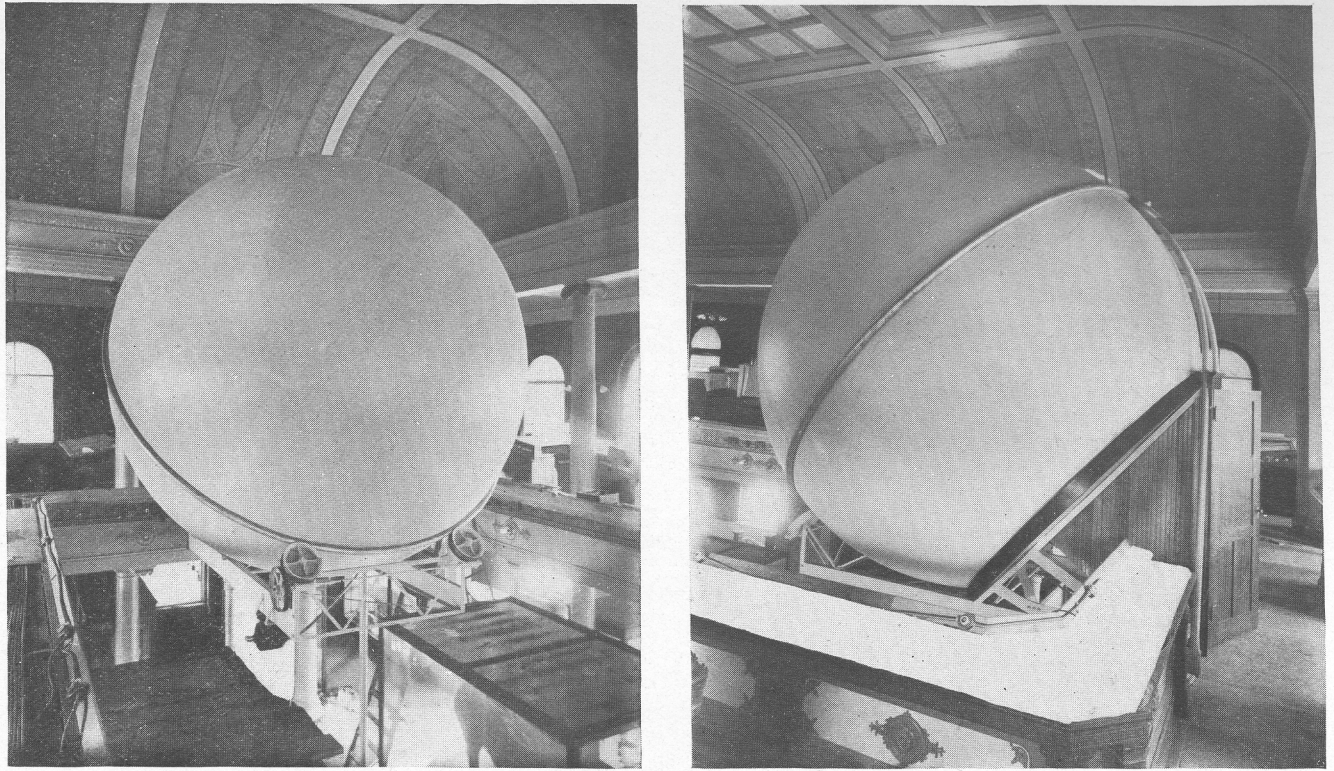
Chicago Academy of Sciences

The Atwood Celestial Sphere

Including a guide for the identification
of the stars represented in the sphere

PRICE 10 CENTS

CHICAGO
Published by the Academy
May, 1913



AN ATWOOD CELESTIAL SPHERE
Invented by Wallace W. Atwood, Secretary of the Society and Director of the Museum.
Constructed, installed and presented to the Academy by LaVerne W. Noyes, President of the Board of Trustees.

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The Atwood Celestial Sphere

Prepared for publication by the Secretary
WALLACE W. ATWOOD

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ESCAPE AT BEDTIME

The lights from the parlor and kitchen shone out
  Through the blinds and the windows and bars;
And high overhead and all moving about,
  There were thousands of millions of stars.
There ne'er were such thousands of leaves on a tree,
  Nor of people in church or the Park,
As the crowds of the stars that looked down upon me,
  And that glittered and winked in the dark.

The Dog, and the Plough, and the Hunter, and all,
  And the star of the sailor, and Mars,
These shone in the sky, and the pail by the wall
  Would be half full of water and stars.
They saw me at last, and they chased me with cries,
  And they soon had me packed into bed;
But the glory kept shining and bright in my eyes,
  And the stars going round in my head.

—*Robert Louis Stevenson.*

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THE ATWOOD CELESTIAL SPHERE

As one looks out at night upon a clear sky the impression gained is of an hemispherical dome of almost infinite size, studded with stars. The Celestial Sphere gives a miniature reproduction of this surface which we call the sky and in which the stars are commonly imagined to be placed. Necessarily the Celestial Sphere is of almost microscopic size, as compared with the universe, and if the Earth were represented in proportion it would be a tiny ball located exactly in the center of the sphere. The observer would be a correspondingly small being, located on this tiny ball.

The Earth is so large as compared with a man that, as he stands on its surface, it looks flat to him. He can only see one half of the heavens at one time: the half which lies above the plane bounded by the horizon. In the Celestial Sphere there is provided an horizon table surrounding the observer and extending out almost to the sphere. The rim of the horizon table is horizontal and is in the same plane as the center of the sphere. A complete hemispherical dome is therefore exposed to the view of the observer and the other hemisphere is obscured from view by the horizon table and the observer's platform.

As the Earth turns upon its axis, the sun, moon and stars appear above the horizon at the East, pass overhead and sink from view at the West, and it seems as though the sky were moving instead of the Earth. It is as though the universe were rotating about the Earth's axis.

So, in this apparatus, the sphere is mounted to rotate about the miniature Earth, which we have imagined as being placed exactly in the center of the sphere. Thus the sun, moon and stars appear at the East and pass overhead, following precisely similar paths to those followed by the real stars in the real sky.

There are certain parts of the heavens which are never visible

to us at Chicago. Since we are north of the equator we can at no time see the stars in the south polar region. If one were to stand in a level field near Chicago and look straight south, just above the horizon, his line of vision would pass as close to the south pole as is possible from this latitude. And, if he were to continue to look along this line for 24 hours, as the Earth turned, this line of vision would describe a circle on the imaginary spherical surface called the sky. This circle would enclose that part of the sky which is never visible to an observer at Chicago. In constructing the Celestial Sphere, that part of the spherical shell coming within this circle was omitted, thus leaving an opening for the entrance of observers and for supporting trusses for the observer's platform.

No part of this opening ever appears above the horizon and the omission of this part of the sperical surface in no way interferes with correct representation of the sky for this latitude. The diameter of this opening subtends an arc of 83° 40′ on the spherical shell, or twice 41° 50′, the latitude of Chicago.

The Educational Value

Probably every seeing person has sometime looked with wonder and curiosity at the brighter stars in the heavens. Most of them are great suns, thousands of billions of miles away from the Earth, at least as bright as our Sun, and possibly the centers of systems comparable in size and in number of planets with our Solar System. The study of these heavenly bodies may, in a most wonderful way, develop powers of imagination, give to the students of Astronomy some conception of the magnificent distances between the heavenly bodies, train the powers of accurate observation and exact reasoning, and above all, lead on to some appreciation of the wonderful symmetry and the wonderful examples of growth or evolution in the Universe in which we live. The earliest intelligent people who lived on the earth studied the stars, and from this study learned some of the fundamental facts about the shape and size of the Earth. The shepherds of ancient Greece, more than 3,000 years ago while out on the hills with their flocks, became familiar with many of the great groups of stars and gave those groups names which are yet in use. Thus, Ursa Major, or the great bear; Ursa Minor, the little bear; Canis Major, the great dog; Taurus, the bull; Orion; the

Pleiades and Cassiopeia are names of some of the great constellations with which everyone should become familiar.

During the last 3,000 years, the study of astronomy has so increased that to-day no child's education should be considered broad or completed until he has become familiar with the main facts about the Universe in which the Earth is a part.

The Chicago Academy of Sciences has appreciated the increasing interest in the stars, and the difficulty which everyone meets in trying to become familiar with even the brighter stars and more commonly known constellations. Various plans for promoting this study were considered by the Academy. The flat star charts are confusing to the untrained observer, and the globes, on the outside of which stars are sometimes represented, are unsatisfactory.

Through the use of the Celestial Sphere, it is possible to become familiar with all the constellations that are ever visible in the latitude of Chicago. Few people have had the opportunity of seeing all of these constellations, for on a given evening it is possible to see but a few of them and the apparent motion is so slow that it would take hours and hours of careful watching to see all of those visible on a single perfectly clear night.

The stars of the first, second, third, fourth, and a selected number of those of the fifth magnitude, visible from the latitude of Chicago, are represented in the sphere, and the total number is 692. In addition to the fixed stars, four planets, Venus, Mars, Jupiter and Saturn are represented, as well as the Sun and the Moon. The celestial equator is clearly marked in the interior of the sphere, and the ecliptic, or apparent yearly path of the Sun among the stars, is also shown.

Many of the mathematical conceptions necessary for the study of descriptive astronomy and which often discourage the beginner, are made, with this sphere, perfectly simple. There is now no reason why anyone, including the younger school children, can not become familiar with the chief constellations, their apparent movements, the brighter stars and the real and apparent movements of the Sun, Moon and Planets.

Many of the fundamental ideas in mathematical geography necessary in elementary education are also easily demonstrated with the sphere.

This apparatus should therefore prove to be of great practical

value in the educational work of the Academy. The public and private school children should make frequent visits to the sphere and the students in Astronomy in the neighboring Universities will find it well worth their time to arrange excursions with their instructors to the Academy to make use of this apparatus in their studies.

A Gift to the Academy

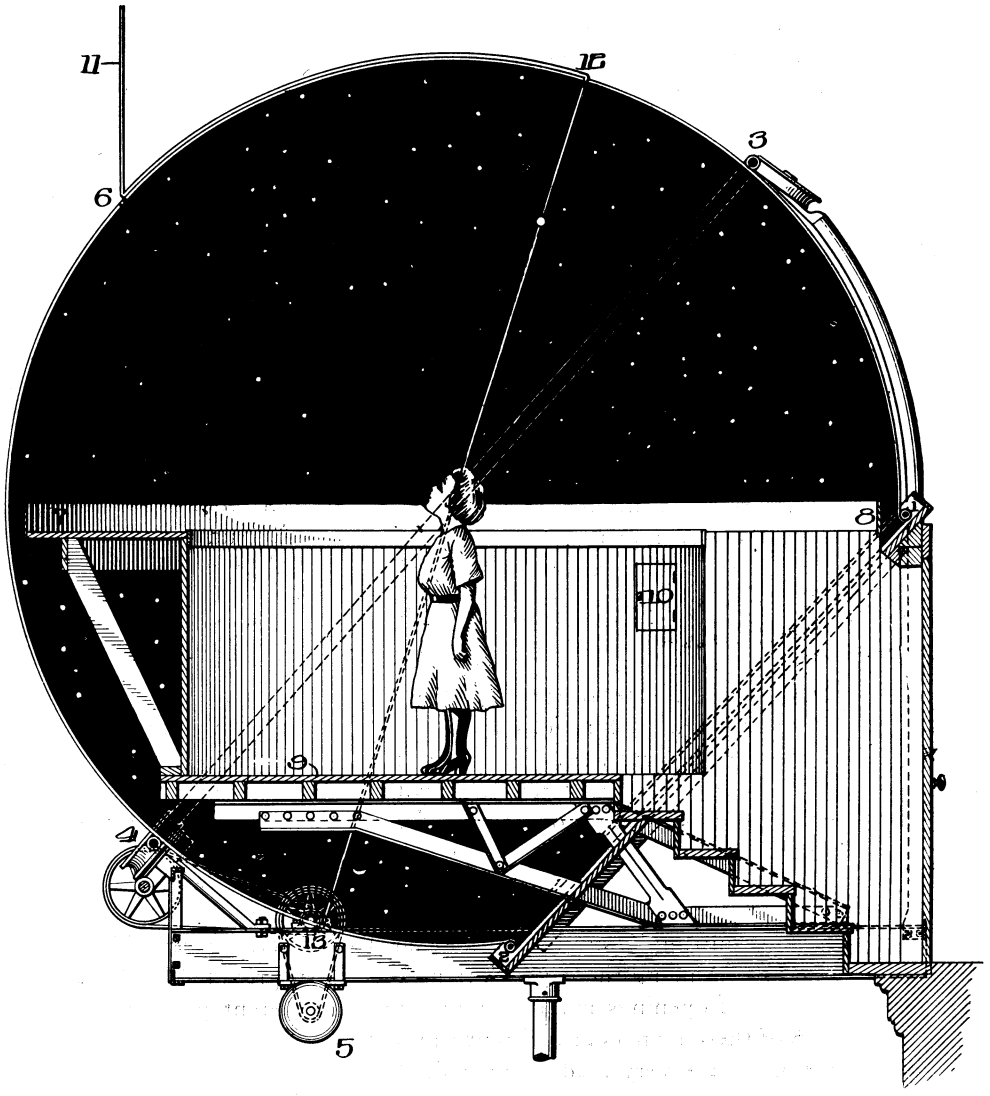
The sphere now in the Academy building was invented by Wallace W. Atwood, Secretary of the Society and Director of the Museum. It was constructed, installed and presented to the Academy by Mr. LaVerne W. Noyes, President of the Board of Trustees, in order to broaden and to promote the educational and scientific work of the Academy.

The members of the Academy and of the community will certainly appreciate the engineering skill and the generosity of Mr. Noyes in this gift to the institution.

The Construction

The material used in constructing the sphere is very light galvanized sheet-iron, $\frac{1}{64}$ of an inch thick, which has been pressed to the proper curvature and soldered to the equatorial ring and to a much smaller ring about the entrance to the sphere. The separate sheets lap sufficiently to be soldered upon one another. The platform and horizon table are of wood and rest upon a very strong steel frame.

The diameter of the sphere is fifteen feet. The weight, exclusive of the platform, is a little more than 500 pounds. This weight is carried by a 2½-inch tube attached to the outside of the sphere along the line of the equator and resting upon three wheels as shown in the cross section view. The two lower wheels carry the greater portion of the weight, but the third and upper wheel, above the door, resists a certain thrust due to the inclined position of the sphere. The stationary platform within the sphere is supported in part by steel trusses resting upon the framework of the museum balcony, and in part by two upright pillars which rest upon the great I beam of the main floor of the Museum. This platform carries a circular horizon table, below which the sphere is obscured from view, and above which there is a complete hemisphere on which the stars are represented.



NORTH-SOUTH CROSS SECTION OF SPHERE

1–2. South Polar Ring at entrance.
3. Upper Wheel supporting sphere.
4. One of two lower wheels which support the sphere and are propelled by motor.
5. Electric Motor.
6. North Pole of the heavens.
7–8. Horizon Table.
9. Observers' Platform.
10. Switch Board.
11. Electric Wire.
12–13. Ecliptic or apparent path of the Sun.

The observer in this sphere is located on the surface of the Earth at North Latitude 41° 50′. Celestial spheres constructed for localities having other latitudes North or South would be placed at other angles and certain other constellations would be represented. Thus a celestial sphere constructed for Buenos Aires, to represent the southern heavens, would be so placed that the observer would enter from the north polar region and see the southern constellations, not visible at Chicago, observe the courses of Sun and Moon north of him but fail to see any of the constellations about the north pole of the heavens as seen from the latitude of Chicago.

Attached to the steel structure supporting the sphere is a small electric motor, which propels the two lower wheels supporting the sphere and their rotation causes the sphere to rotate.

The electric power for rotating the sphere and the light for illuminating the interior are controlled from within the sphere. The electric current necessary for representing the Sun is received at the north pole at a rotary contact, and carried by an insulated wire to the ecliptic, about which there is a wire on the inside of the sphere.

The Fixed Stars

The stars are represented by tiny perforations in the sphere. Different sized perforations have been made to represent stars of different magnitudes. The size and location of each star in the sphere has been determined with great care by using an instrument especially constructed for this purpose, so that the sphere is an accurate miniature representation of the heavens.

The Planets

The shifting positions of the planets Jupiter, Saturn, Mars and Venus among the constellations have been provided for by a number of openings made to represent the different positions of each of these planets at different times of the year. The openings not in use are very readily covered.

The Sun and Moon

The Sun is represented by a small electric light which may be moved from day to day along the ecliptic and thus kept in its appropriate place in the heavens.

The Moon is represented by a series of small discs cut to cor-

respond to the various phases of the Moon and coated with a luminous salt. These discs may be moved from point to point along the orbit of the Moon and thus represent that body with its appropriate form and position.

SOME ESSENTIAL FACTS ABOUT ASTRONOMY

A GUIDE FOR THOSE USING THE SPHERE

The Solar System

The solar system consists of the Sun, the Planets with their satellites, or moons, and the Planetoids, or small planets. The planets arranged in their order of distance from the Sun are: Mercury, Venus, Earth, Mars, Planetoids, Jupiter, Saturn, Uranus, and Neptune.

Mercury

Mercury, the innermost planet, is seldom seen, for it is so near the Sun that it appears but for a short time after sunset near the western horizon, or for a short time before sunrise near the eastern horizon. Its position changes very frequently.

Venus

Venus, one of the most brilliant objects in the heavens, revolves about the sun once in seven months. Its year, therefore, is much less than that of the Earth. Being nearer the Sun than the Earth it always appears as an evening or morning star, but being farther from the Sun than Mercury it can be seen much longer after sunset or before sunrise at the proper seasons. Venus, like the Moon, shines by reflected light and like the Moon, has its various phases. It has an extensive atmosphere, probably comparable to that of the Earth, which prevents our seeing much of its surface. In dimensions, year, and general physical conditions it is much like the Earth.

The Earth

The Earth is the third planet in order of distance from the Sun and has a diameter of about 8,000 miles and a circumference of about 25,000 miles. It is large enough to hold, through gravitative power, the light gases of our atmosphere, and this atmosphere serves as a blanket, retaining sufficient heat, received from the Sun, to make the surface of the Earth habitable. If

any other bodies in the Solar System are inhabited, this Earth must appear to those inhabitants somewhat as Venus appears to us.

A complete revolution of the Earth about the Sun takes 365¼ days, or one year, but the rotation of the Earth on its axis is accomplished once in 24 hours. The apparent daily motion of the Sun and fixed stars is due to the rotation of the Earth on its axis. The inclined position of the Earth's axis. 23½ degrees from the perpendicular to the plane of its orbit, associated with the movements of rotation and of revolution, gives to the Earth varying lengths of days and nights and seasonal changes.

Mars

The planet Mars, next beyond the Earth in order from the Sun, has attracted unusual attention for several years, because of certain climatic changes which are evidently going on there, giving seasonal variations in the extent of the polar cap. There are also certain very faint markings seen on this planet, the so-called "Canals," which have suggested to some few observers that it may be inhabited by a highly intelligent race of beings. Mars is a beautiful red planet. It rotates on its axis once in a little more than 24 hours, and revolves about the Sun in about 23 months. This planet has two satellites.

The Planetoids

The Planetoids are a number of small planets existing in space between Mars and Jupiter. Each Planetoid has its independent orbit about the Sun. Eight hundred Planetoids are known but they are so small that they cannot be seen by the unaided eye.

Jupiter

Jupiter is the largest of the planets, and one of the most brilliant objects in the heavens. This planet rotates on its axis once in about ten hours and the period of its revolution about the Sun is about twelve years. Jupiter, therefore, appears to move very slowly among the fixed stars, and may be recognized, when once identified, for many months. Jupiter has at least eight moons.

Saturn

The planet Saturn, next beyond Jupiter, is peculiar in that it has, in addition to eight satellites or moons, three remarkable

rings made up of small particles which move about the planet. Saturn rotates on its axis in about ten hours and revolves about the Sun in about thirty years.

Table of Solar System

	Distance from the Sun in Millions of Miles			Periodic time in years	Mean diam. in miles
	Mean	Least	Greatest		
Mercury	36	28.6	43.3	.24	3,030
Venus	67.2	66.5	67.5	.61	7,700
Earth	92.9	91.1	94.6	1.	7,918
Mars	141	128	155	1.88	4,230
Jupiter	483	459	505	11.6	86,500
Saturn	886	834	936	3.2	71,000
Uranus	1,782	1,700	1,860	86.0	31,900
Neptune	2,792	2,760	2,810	83.3	34,800

Eclipses of the Sun and Moon

At certain definite periods the Earth is between the Sun and Moon in just such a position as to throw its shadow on the surface of the Moon, causing a partial or total eclipse of the Moon. When the Moon passes between the Earth and the Sun, and at just the appropriate distance, the shadow of the Moon falls upon the Earth, and those within that shadow cannot see the Sun at all, or only in part. In this way a partial or total eclipse of the Sun is caused.

Shooting Stars

The Shooting Stars are masses of matter drifting through space which enter the atmosphere of the Earth. Such bodies as they pass through the atmosphere are heated until they emit light, and appear to us as red or yellow. Most of them are probably burned to gas before passing through the atmosphere but some of them yield a fine dust and that dust falls to the Earth's surface.

The few Shooting Stars that penetrate through the atmosphere and strike the Earth are spoken of as meteorites, and only a small proportion of those which actually come to the earth are found. Collections of such meteoric material are exhibited at most of the large museums of the country. The Field Museum in Chicago has a remarkable and valuable collection.

The Nebulae

In addition to the Planets, the Sun, the Moon and the fixed stars, there are in the heavens a remarkable number of Nebulæ, which are today attracting great attention among all students of astronomy and others interested in the evolution of the Solar System. The most common form of nebula now known is the Spiral. There are more spiral nebulae known than all other types of nebulae combined. These nebulae are known to be composed of solid and liquid particles surrounded by gaseous material. The largest spiral nebula known is in the constellation of Andromeda. The diameter of this nebula is probably thousands of times the distance of the Earth from the Sun.

The spiral nebulae are of peculiar interest just now because the leading hypothesis on the origin of the Solar System is based on the evolution of that system from a small spiral nebula.*

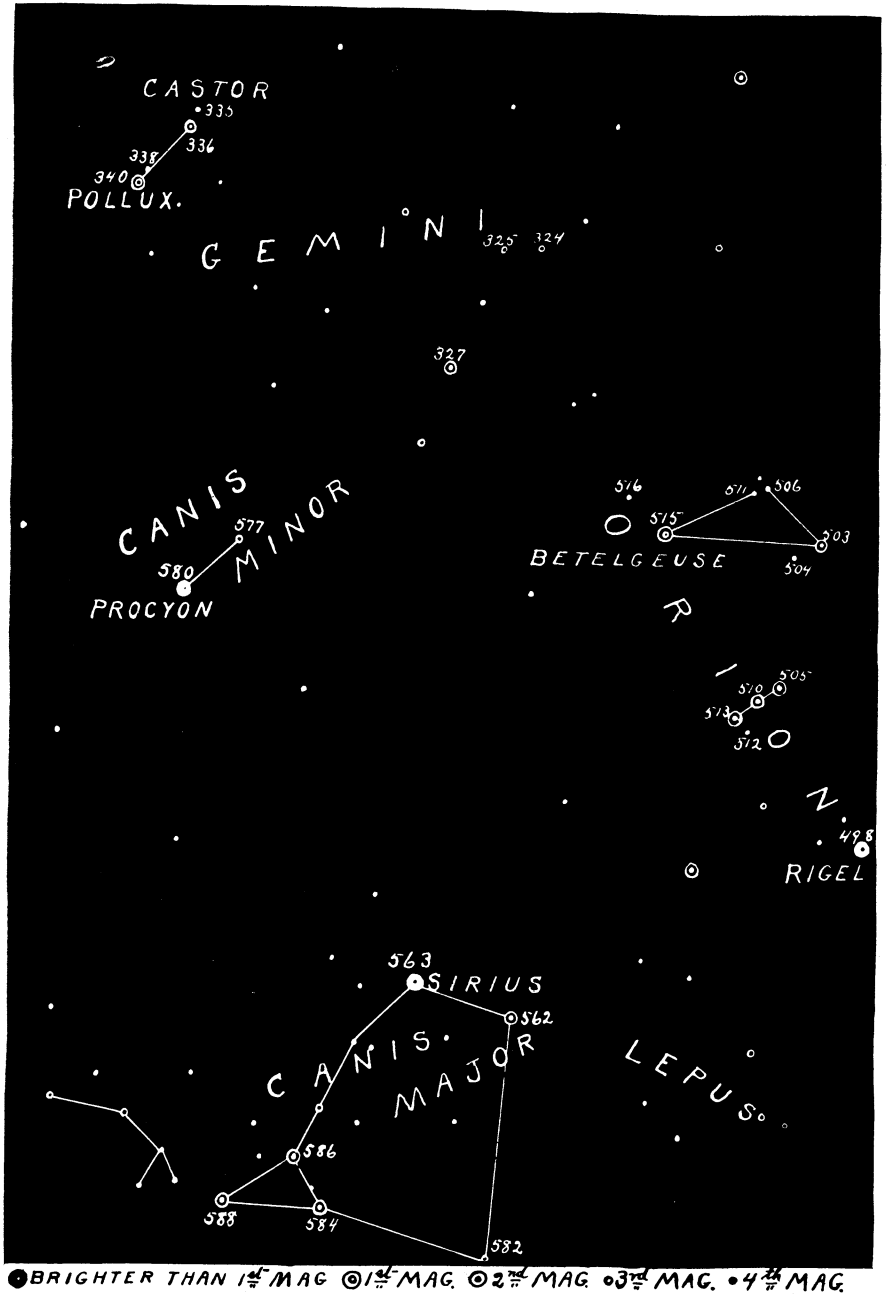
There are a few ring nebulae in the heavens. The one best known is that in the constellation Lyra. The origin of these is beyond conjecture.

In addition to the spiral and ring nebulae there are a number of nebulous bodies which are very irregular but extremely beautiful. The most beautiful object in the heavens when seen with a telescope is the great nebula Orion. Large transparencies made from photographs of several of the nebulae are on exhibition in the Academy Museum.

THE FIXED STARS

With the exception of the four planets represented in the Sphere all the other stars are spoken of as "fixed." They do not belong to the Solar System, but are very far separated from Neptune, the outermost planet of that system. They are so far distant that even though they have some motions, those motions are not appreciable, except through most careful observations. The number of these stars, up to and including those of the sixth magnitude, is given in the following table. The stars smaller than the sixth magnitude are not visible to the unaided eye.

* Chamberlin & Salisbury, Geology, Vol. II.
F. R. Moulton, Introduction to Astronomy.



CONSTELLATIONS NEAR ORION.
The numbers correspond to numbers in the sphere and in the star tables.

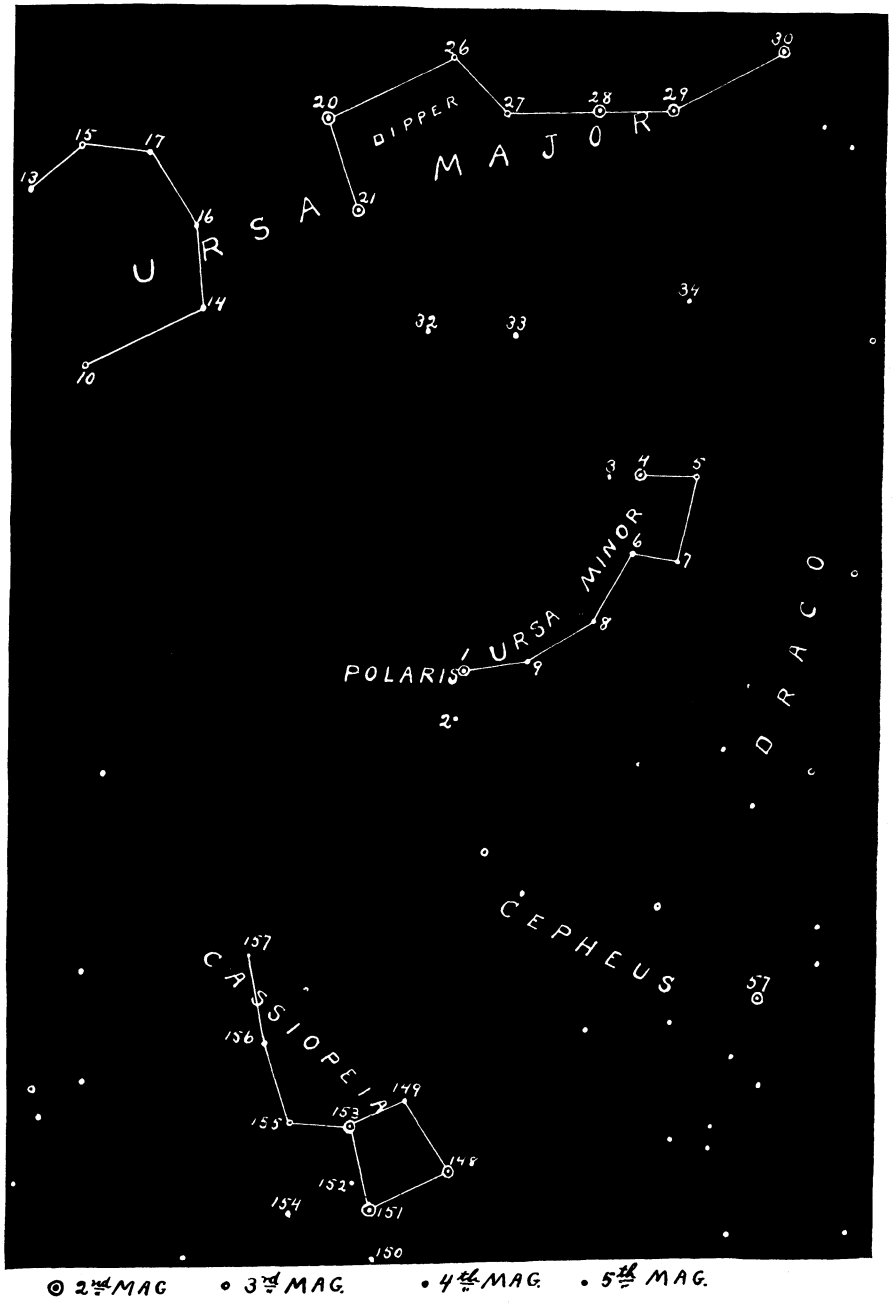
The approximate number of stars visible from the Earth without the help of telescope:

1st magnitude or brighter	20
2nd "	65
3rd "	190
4th "	425
5th "	1,100
6th "	3,200
Total	5,000

The brightness of the stars differs partly because of differences in their light-giving power but mostly because of their very unequal distances from us. The nearest of these fixed stars is four light years away from the Earth and the most distant ones which are visible with present instruments are believed to be over 10,000 light years away. Light travels at the rate of 186,000 miles per second, and traveling at that rate would in one year travel 5,865,696,000,000 miles. This unit, known as a "light year," has been found convenient in referring to the distance of the fixed stars from the Earth. Thus the distance of the Pole Star is about forty light years away, which means that it takes light forty years to travel at 186,000 miles a second to come from the North Star to the Earth. If that star should go out or become cold today, we would not know that fact for forty years, for the light would continue to come to us from that part of the heavens during that entire time. The group of stars known as the Pleiades are so far away that it takes light something like 267 years to come from them to us.

The amount of light emitted by some of these stars, when compared to that given out by the Sun, makes our source of light and heat appear insignificant. The amount of light radiated by Capella is 220 times as much as our Sun. Vega, a bright star in the constellation Lyra, emits 100 times as much light as our Sun. Arcturus, the brightest star in Boötes, has a brightness 1,300 times that of our Sun.

All of the fixed stars should be thought of as other suns, and they may be centers of other great systems much greater in size and number of planets than the Solar System.



CONSTELLATIONS ABOUT THE NORTH POLE OF THE HEAVENS.
The numbers correspond to numbers in the sphere and in the star tables.

THE CONSTELLATIONS

The fixed stars are not uniformly scattered throughout space but arranged in groups. These groups are called constellations and each constellation is characterized by a number of the brighter stars. "The natural grouping was noticed in prehistoric times and was of more interest to primitive peoples, spending their lives in the open air under skies which were nearly always clear, than it is to the ordinary person in this age of houses and artificial light. Besides the ancients were highly imaginative and, like the children, they secured a sort of companionship for themselves by seeing all kinds of living creatures in inanimate objects, and they often wove about them the most fantastic romances. They saw in the natural aggregations of stars the forms of all sorts of animals, whose names are given in the groups, or constellations."*

The stars in the sphere have been numbered and the star tables are arranged in numerical order, so by reference to these tables the name or position of any star may be easily referred to by number. Thus, No. 1 is Polaris, the North Star. It is not exactly at the Pole, being separated by one degree and 20 minutes from the real pole of the heavens.

Stars numbered 1 to 9 belong to the constellation Ursa Minor, those from 11 to 30 inclusive to Ursa Major. Thus a group of stars may be picked out in the sphere by their numbers. If a certain star or a certain constellation is wanted, reference to the index at the close of the book makes that perfectly simple. The names of stars and of constellations and other matters of interest are all arranged alphabetically in the index.

*Moulton's Introduction to Astronomy, p. 47.

STAR TABLES

No. in Sphere	Constellation	Name	Letter	Mag.	R. A. h. m.	R. A. Degrees	Decl'n ° ′
1	Ursa Minor	Polaris	α	2.2	1.14	18½	+88 40
2	"	.....	2 Fl.	4.5	0.52	13	+85 37
3	"	.....	5 Fl.	4.3	14.28	217	+76 14
4	"	Kochab	β	2.1	14.51	222¾	+74 39
5	"	.....	γ	3.2	15.21	230¼	+72 16
6	"	.....	ζ	4.5	15.48	237	+78 10
7	"	.....	η	5.0	16.21	255¼	+76 2
8	"	.....	ε	4.5	16.58	264½	+82 14
9	"	.....	δ	4.3	18.11	282¾	+86 37
10	Ursa Major	.....	ο	3.4	8.20+	125	+61 8
11	"	.....	ι	3.2	8.51	132¾	+48 31
12	"	.....	κ	3.7	8.55+	133¾	+47 48
13	"	.....	f	4.4	9.0	135	+52 5
14	"	.....	h	3.7	9.22	140½	+63 35
15	"	.....	θ	3.2	9.25	141¼	+52 13
16	"	.....	υ	4.0	9.42+	145½	+59 36
17	"	.....	φ	4.4	9.44	146	+54 38
18	"	.....	λ	3.6	10.10	152½	+43 31
19	"	.....	μ	3.1	10.15	153¾	+42 6
20	"	Mirak	β	2.6	10.54	163½	+57 1
21	"	Dubhe	α	2.0	10.56	164	+62 24
22	"	.....	ψ	3.1	11.3	165¾	+45 9
23	"	.....	ξ	3.8	11.12	168	+32 18
24	"	.....	υ	3.8	11.12	168	+33 45
25	"	.....	χ	3.9	11.39	174¾	+48 27
26	"	Phecda	γ	2.6	11.47	176¾	+54 22
27	"	Megrez	δ	3.4	12.9+	182¼	+57 42
28	"	Alioth	ε	1.8	12.48	192	+56 37
29	"	Mizar	ζ	2.4	13.19	199¾	+55 33
30	"	Alkaid	η	2.0	13.43	205¾	+49 55
31	Draco	.....	{B A C 3199}	4.6	9.20	140	+81 51
32	"	.....	λ	4.1	11.24	171	+70 0
33	"	.....	κ	3.8	12.28	187	+70 27
34	"	.....	α	3.6	14.1	210¼	+64 57
35	"	.....	ι	3.4	15.21	230½	+59 23
36	"	.....	θ	4.2	15.59	239¾	+58 53
37	"	.....	η	2.8	16.22	245½	+61 47
38	"	.....	h′	4.7	16.55	253¾	+65 19
39	"	.....	ζ	3.3	17.8	257	+65 52
40	"	.....	β	3.0	17.27	262	+52 23
41	"	.....	ν′	4.9	17.29	262½	+55 16
42	"	.....	ω	4.9	17.37	264½	+68 49
43	"	.....	3σ	5.2	17.46	266½	+50 50
44	"	.....	ξ	3.9	17.51	267¾	+56 54
45	"	.....	γ	2.4	17.53	268½	+51 30
46	"	.....	6	4.8	18.22	275½	+58 44
47	"	.....	c	5.2	18.40	280	+55 25
48	"	.....	ο	4.6	18.49	282¼	+59 14
49	"	.....	δ	3.2	19.12	288	+67 27
50	"	.....	π	4.6	19.20	290	+65 29
51	"	.....	σ	4.7	19.32	293	+69 27
52	"	.....	ε	3.9	19.48	297	+69 58
53	"	.....	ρ	4.6	20.2	300½	+67 32
54	Cepheus	.....	κ	4.4	20.13	303¼	+77 21

STAR TABLES — *Continued*

No. in Sphere	Constellation	Name	Letter	Mag.	R. A. h. m.	R. A. Degrees	Decl'n ° ′
55	Cepheus	.....	θ	4.3	20.27	306¾	+62 35
56	"	.....	η	3.6	20.42	310¾	+61 22
57	"	Alderamin	α	2.6	21.15	319	+62 5
58	"	.....	β	3.4	21.27	321¾	+70 2
59	"	.....	Fl. 9	4.8	21.34	323¾	+61 32
60	"	.....	μ	3.9	21.40	325	+58 14
61	"	.....	Fl. 11	4.8	21.40	325	+70 46
62	"	.....	ν	4.5	21.42	325½	+60 34
63	"	.....	ξ	4.4	22.0	330	+64 3
64	"	.....	ζ	3.5	22.6	331½	+57 37
65	"	.....	ϵ	4.2	22.10	332½	+56 27
66	"	.....	δ	4.0	22.24	336¼	+57 48
67	"	.....	ι	3.6	22.45	341¼	+65 34
68	"	.....	π	4.5	23.4	346	+74 44
69	"	.....	o	4.9	23.13	348½	+67 28
70	"	.....	γ	3.4	23.42	353½	+76 58
71	Boötes	.....	ν	4.1	13.43	206	+16 24
72	"	.....	η	2.9	13.49	207¼	+19 0
73	"	.....	d	4.8	14.5	211¼	+25 40
74	"	Arcturus	α	0.0	14.10	212½	+19 48
75	"	.....	λ	4.3	14.11	213	+46 38
76	"	.....	Fl. 20	4.9	14.14	213½	+16 51
77	"	.....	θ	4.2	14.21	215¼	+52 24
78	"	.....	ρ	3.6	14.26	216¾	+30 54
79	"	.....	γ	3.1	14.27	217	+38 50
80	"	.....	ζ	3.8	14.35	218¾	+14 15
81	"	.....	ϵ	2.6	14.39	220	+27 35
82	"	.....	ξ	4.6	14.46	221½	+19 36
83	"	.....	β	3.6	14.57	224¼	+40 52
84	"	.....	ψ	4.5	14.59	224¾	+27 25
85	"	.....	δ	3.5	15.10	227¾	+33 46
86	"	.....	μ	4.4	15.20	230	+27 48
87	Corona Borealis	.....	β	3.8	15.23	230¾	+29 31
88	"	.....	θ	4.3	15.28	232	+31 46
89	"	.....	α	2.4	15.29	232½	+27 7
90	"	.....	ζ	4.8	15.35	233¾	+37 2
91	"	.....	γ	4.2	15.37	234¼	+26 41
92	"	.....	δ	4.6	15.44	236	+26 26
93	"	.....	κ	4.7	15.46	236½	+36 2
94	"	.....	ϵ	4.1	15.52	238	+27 14
95	"	.....	ξ	4.5	16.17	244¼	+31 10
96	Hercules	.....	χ	4.5	15.48	237	+42 47
97	"	.....	ϕ	4.2	16.5	241¼	+45 15
98	"	.....	τ	3.9	16.16	244	+46 36
99	"	.....	γ	3.8	16.16	244¼	+19 26
100	"	.....	ω	4.7	16.20	245	+14 19
101	"	.....	β	2.8	16.25	246¼	+21 45
102	"	.....	σ	4.2	16.30	247½	+42 42
103	"	.....	ζ	3.1	16.36	249¼	+31 49
104	"	.....	η	3.7	16.38	249¾	+39 9
105	"	.....	ϵ	4.0	16.55	254	+31 6
106	"	.....	α	3.2	17.9	257¼	+14 32
107	"	.....	δ	3.3	17.10	257½	+24 59
108	"	.....	π	3.4	17.11	257¾	+36 57
109	"	.....	λ	4.3	17.26	261½	+26 12

STAR TABLES — *Continued*

No. in Sphere	Constellation	Name	Letter	Mag.	R. A. h. m.	R. A. Degrees	Decl'n ° ′
110	Hercules	.....	ι	3.9	17.36	264	+46 4
111	"	.....	μ	3.5	17.41	265½	+27 48
112	"	.....	θ	4.0	17.52	268	+37 16
113	"	.....	ξ	3.9	17.53	268¼	+29 16
114	"	.....	ο	4.0	18.3	270¾	+28 45
115	"	.....	Fl. 102	4.5	18.3	271	+20 49
116	"	.....	A	4.9	18.7	271¾	+31 22
117	"	.....	Fl. 109	3.9	18.18	274½	+21 43
118	"	.....	Fl. 110	4.2	18.40	280	+20 26
119	"	.....	Fl. 113	4.6	18.49	282½	+22 30
120	Lyra	.....	κ	4.4	18.15	273¾	+36 1
121	"	Vega	α	0.2	18.33	278¼	+38 40
122	"	.....	ζ	4.3	18.40	280	+37 29
123	"	.....	β	3.6	18.45	281¼	+33 13
124	"	.....	δ^2	4.5	18.50	282½	+36 45
125	"	.....	Fl. 13	4.4	18.51	283	+43 47
126	"	.....	γ	3.2	18.54	283½	+32 32
127	"	.....	η	4.5	19.9	287½	+38 56
128	"	.....	θ	4.3	19.12	288	+37 55
129	Cygnus	.....	κ	3.9	19.14	288½	+53 9
130	"	Albiteo	β′	3.1	19.26	291½	+27 43
131	"	.....	ι	3.9	19.26	291¾	+51 28
132	"	.....	φ	4.9	19.34	293½	+29 53
133	"	.....	δ	3.0	19.41	295¼	+44 50
134	"	.....	χ	5.0	19.41	295½	+33 27
135	"	.....	Fl. 22	4.7	19.51	297¾	+38 10
136	"	.....	η	4.0	19.52	298	+34 46
137	"	.....	o^2	3.8	20.10	302½	+46 23
138	"	.....	Fl. 32	4.1	20.11	303	+47 21
139	"	.....	γ	2.3	20.18	304½	+39 52
140	"	.....	Fl. 41	4.1	20.24	306	+29 58
141	"	Deneb	α	1.5	20.37	309¼	+44 51
142	"	.....	ε	2.7	20.41	310¼	+33 31
143	"	.....	ν	4.1	20.52	313¼	+40 42
144	"	.....	ξ	3.7	21.0	315	+43 27
145	"	.....	ζ	3.5	21.7	317	+29 44
146	"	.....	τ	3.9	21.10	317½	+37 32
147	"	.....	ρ	4.2	21.29	322¼	+45 4
148	Cassiopeia	Caph	β	2.4	0.3	¾	+58 29
149	"	.....	κ	4.2	0.26	6½	+62 16
150	"	.....	ζ	3.7	0.30	7½	+53 14
151	"	Schedar	α	2.2	0.33	8¼	+55 53
152	"	.....	η	3.6	0.42	10½	+57 11
153	"	.....	γ	2.3	0.49+	12¼	+60 4
154	"	.....	θ	4.4	1.3	15¾	+54 31
155	"	.....	δ	2.8	1.18	19½	+59 37
156	"	.....	ε	3.6	1.46	26½	+63 5
157	"	.....	ι	4.6	2.19	34¾	+66 52
158	Perseus	.....	θ	4.2	2.36	39	+48 43
159	"	.....	η	3.9	2.42	40½	+55 24
160	"	.....	τ	4.0	2.45	41½	+52 16
161	"	.....	γ	3.1	2.56	44	+53 2
162	"	.....	ρ	3.7	2.57	44¼	+38 22
163	"	.....	ι	4.1	3.0	45	+49 9
164	"	Algol	β	2.3	3.0	45	+40 30

STAR TABLES — *Continued*

No. in Sphere	Constellation	Name	Letter	Mag.	R. A. h. m.	R. A. Degrees	Decl'n ° ′
165	Perseus	.....	κ	4.0	3.1	45¼	+44 24
166	"	Mirfac	α	1.9	3.15+	49	+49 26
167	"	.....	ψ	4.2	3.28	52	+47 48
168	"	.....	δ	3.2	3.34	53½	+47 24
169	"	.....	o	5.0	3.35	53¾	+33 34
170	"	.....	o′	4.0	3.36	54¼	+31 54
171	"	.....	ν	4.0	3.37	54¼	+42 12
172	"	.....	ζ	3.1	3.46	56½	+31 34
173	"	.....	ϵ	3.0	3.49	57½	+39 40
174	"	.....	ξ	4.1	3.51	57¾	+35 27
175	"	.....	λ	4.5	3.57	59½	+50 1
176	"	.....	c	4.3	4.0	60	+47 24
177	"	.....	μ	4.2	4.6	61½	+48 6
178	"	.....	e	4.4	4.28	67	+41 1
179	Auriga	.....	ι	2.7	4.49	72¼	+32 58
180	"	.....	ϵ	3.2	4.53	73¼	+43 39
181	"	.....	ζ	4.0	4.54	73½	+40 54
182	"	.....	η	3.3	4.58	74¼	+41 4
183	"	Capella	α	0.2	5.7	77	+45 52
184	"	.....	τ	4.6	5.41	85¼	+39 8
185	"	.....	ν	4.2	5.43	85¾	+39 7
186	"	.....	δ	3.3	5.49	87¼	+54 16
187	"	.....	β	2.1	5.50	87¾	+44 57
188	"	.....	θ	2.7	5.51	88	+37 12
189	"	.....	ψ^{10}	4.7	6.49	102¼	+45 17
190	Ophiuchus	.....	δ	2.8	16.8	242	− 3 23
191	"	.....	ϵ	3.4	16.12	243	− 4 24
192	"	.....	ϕ	4.4	16.24	246	−16 21
193	"	.....	λ	4.0	16.25	246¼	+ 2 15
194	"	.....	ζ	2.8	16.30	247½	−10 19
195	"	.....	i	4.4	16.48	252	+10 22
196	"	.....	κ	3.4	16.52	253	+ 9 34
197	"	.....	η	2.6	17.3	255¾	−15 34
198	"	.....	θ	3.4	17.14	258¾	−24 53
199	"	.....	σ	4.4	17.20	260	+ 4 15
200	"	.....	α	2.2	17.29	262¼	+12 39
201	"	.....	β	2.9	17.37	264¼	+ 4 37
202	"	.....	γ	3.8	17.42	265½	+ 2 45
203	"	.....	ν	3.5	17.52	268	− 9 45
204	"	.....	Fl. 67	4.0	17.54	268¾	+ 2 56
205	"	.....	Fl. 70	4.1	17.59	269¾	+ 2 32
206	"	.....	Fl. 72	3.8	18.1	270½	+ 9 33
207	Serpens	.....	δ	4.0	15.29	232¼	+10 57
208	"	.....	ι	4.6	15.36	234	+20 3
209	"	.....	α	2.7	15.38	234½	+ 6 48
210	"	.....	β	3.8	15.40	235	+15 48
211	"	.....	λ	4.4	15.40	235	+ 7 44
212	"	.....	κ	4.2	15.43	235¾	+18 31
213	"	.....	μ	3.5	15.43	235¾	− 3 4
214	"	.....	ϵ	3.7	15.44+	236¼	+ 4 50
215	"	.....	ρ	4.8	15.46	236½	+21 20
216	"	.....	γ	4.0	15.51	237¾	+16 3
217	"	.....	ξ	3.7	17.30	262¾	+15 9
218	"	.....	η	3.4	18.15	273¾	− 2 56
219	Sagitta	.....	α	4.3	19.34	293¾	+17 44

STAR TABLES — *Continued*

No. in Sphere	Constellation	Name	Letter	Mag.	R. A. h. m.	R. A. Degrees	Decl'n ° ′
220	Sagitta	.....	β	4.4	19.37	294¼	+17 12
221	"	.....	δ	3.7	19.42	295½	+18 14
222	"	.....	γ	3.6	19.53	298¼	+19 10
223	Aquila	.....	ϵ	4.1	18.54	283½	+14 54
224	"	.....	Fl. 12	4.0	18.55	283¾	− 5 54
225	"	.....	ζ	3.1	19.0	285	+13 41
226	"	.....	λ	3.6	19.0	285	− 5 4
227	"	.....	Fl. 18	5.1	19.15	285¼	+10 53
228	"	.....	ω	5.1	19.1	288	+11 23
229	"	.....	δ	3.5	19.19	289¾	+ 2 53
230	"	.....	ν	4.8	19.20	290	+ 0 6
231	"	.....	μ	4.7	19.28	292	+ 7 8
232	"	.....	ι	4.3	19.30	292½	− 1 33
233	"	.....	γ	2.8	19.40	295	+10 19
234	"	Altair	α	1.0	19.45	296¼	+ 8 33
235	"	.....	η	3.9	19.46	296½	+ 0 42
236	"	.....	β	4.0	19.49	297¼	+ 6 6
237	"	.....	θ	3.4	20.5	301¼	− 1 11
238	Delphinus	.....	ϵ	4.1	20.27	306¾	+10 54
239	"	.....	ζ	4.7	20.29	307½	+14 16
240	"	.....	β	3.7	20.32	308	+14 11
241	"	.....	α	4.0	20.34	308½	+15 29
242	"	.....	δ	4.6	20.38	309½	+14 39
243	Equuleus	.....	γ	4.8	21.4	316	+ 9 39
244	"	.....	δ	4.6	21.8	317	+ 9 31
245	"	.....	α	4.1	21.9	317½	+ 4 45
246	"	.....	β	4.9	21.17	319¼	+ 6 18
247	Pegasus	.....	ϵ	2.4	21.38	324½	+ 9 20
248	"	.....	κ	4.2	21.39	324¾	+25 4
249	"	.....	θ	3.8	22.4	331	+ 5 36
250	"	.....	ζ	3.6	22.35	338¾	+10 12
251	"	.....	η	3.1	22.37	339¼	+29 35
252	"	.....	λ	4.2	22.41	340¼	+22 56
253	"	.....	μ	3.7	22.44	341	+23 58
254	"	Scheat	β	2.6	22.58	344½	+27 26
255	"	Markab	α	2.6	22.59	344¾	+14 34
256	"	.....	δ	2.1	0.2	0½	+28 26
257	"	Algenib	γ	3.0	0.7	1¾	+14 31
258	Triangulum	.....	α	3.6	1.46	26½	+29 0
259	"	.....	β	3.1	2.2	30½	+34 25
260	"	.....	γ	4.2	2.10	32½	+33 17
261	Camelopardus	.....	1058 B A C	4.2	3.19	49¾	+59 31
262	"	.....	γ	4.6	3.37	54¼	+70 58
263	"	.....	1144 B A C	4.6	3.38	54½	+65 9
264	"	.....	α	4.4	4.42	70½	+66 8
265	"	.....	β	4.2	4.52	73	+60 16
266	"	.....	2210 B A C	4.6	6.42	100½	+77 8
267	Lynx	.....	2	4.3	6.9	92¼	+59 3
268	"	.....	15	4.5	6.47	101¾	+58 35
269	"	.....	10	4.2	8.53	133¼	+42 16
270	"	.....	38	3.8	9.11	137¾	+39 19
271	"	.....	α	3.4	9.14	138½	+34 54

STAR TABLES — *Continued*

No. in Sphere	Constellation	Name	Letter	Mag.	R. A. h. m.	R. A. Degrees	Decl'n ° ′
272	Canes Venatici	.....	β	4.3	12.28	187	+42 1
273	"	.....	α	3.0	12.50	192½	+38 58
274	"	.....	20	4.7	13.12	198	+41 12
275	"	.....	4632 BAC	4.9	13.46	206½	+35 2
276	Coma Berenices	.....	γ	4.7	12.21	185¼	+28 54
277	"	.....	α	4.4	13.4	196	+18 10
278	"	.....	β	4.4	13.6	196½	+28 29
279	Lacerta	.....	1	4.1	22.10	332½	+39 9
280	"	.....	β	4.5	22.19	334¾	+51 38
281	"	.....	α	3.9	22.26	336½	+49 40
282	Andromeda	.....	o	3.8	22.56	344	+41 41
283	"	.....	λ	4.0	23.31	352¾	+45 48
284	"	.....	ι	4.3	23.32	353	+42 36
285	"	.....	κ	4.4	23.34	353¾	+43 40
286	"	.....	θ	4.3	0.10+	2¾	+38 1
287	"	.....	π	4.4	0.30	7½	+33 4
288	"	.....	δ	3.4	0.33	8¼	+30 12
289	"	.....	ζ	4.4	0.41	10¼	+23 37
290	"	.....	μ	3.9	0.50	12½	+37 51
291	"	Mirach	β	2.2	1.3	15¾	+34 59
292	"	.....	ν	3.7	1.30	22½	+48 1
293	"	.....	Fl. 54	4.2	1.36	24	+50 5
294	"	Almaac	γ	2.2	1.56	29¼	+41 45
295	Aries	.....	γ^1	5.0	1.47	26¾	+18 42
296	"	.....	β	2.8	1.48	27	+20 13
297	"	.....	λ	4.9	1.51	27¾	+23 1
298	"	.....	α	2.0	2.0	30¼	+22 54
299	"	.....	Fl. 35	4.7	2.36	39	+27 12
300	"	.....	Fl. 41	3.8	2.43	40¾	+26 46
301	"	.....	δ	4.5	3.4	46¼	+19 16
302	Taurus	.....	o	3.8	3.18	49½	+ 8 36
303	"	.....	ξ	3.8	3.20+	50	+ 9 19
304	"	.....	Fl. 17	3.8	3.38	54½	+23 44
305	"	.....	Fl. 19	4.4	3.38+	54½	+24 5
306	"	.....	Fl. 20	4.0	3.38+	54½	+24 0
307	"	.....	Fl. 23	4.2	3.39	54¾	+23 34
308	"	Pleiades	η	3.0	3.40	55	+23 44
309	"	.....		abt 6	3.38	54½	+23 55
310	"	.....		abt 7	3.42	55½	+23 47
311	"	.....	Fl. 27	3.8	3.42	55½	+23 41
312	"	.....	λ	3.6	3.54	58½	+12 9
313	"	.....	ν	4.0	3.57	59¼	+ 5 39
314	"	.....	γ	3.9	4.13	63¼	+15 20
315	"	.....	δ^1	4.0	4.16	64	+17 15
316	"	Hyades	δ^3 Fl 68	4.2	4.18	64½	+17 39
317	"	.....	ϵ	3.7	4.21+	65¼	+18 55
318	"	.....	θ^1	3.9	4.21+	65¼	+15 42
319	"	.....	θ^2	3.6	4.22	65½	+15 36
320	"	Aldebaran	α	1.0	4.29	67¼	+16 16
321	"	.....	τ	4.4	4.35	68¾	+22 44
322	"	.....	β	1.9	5.18+	79½	+28 30
323	"	.....	ζ	3.0	5.30+	82½	+21 4
324	Gemini	.....	η	3.5	6.7	91¾	+22 32

STAR TABLES — *Continued*

No. in Sphere	Constellation	Name	Letter	Mag.	R. A. h. m.	R. A. Degrees	Decl'n ° ′
325	Gemini	.....	μ	3.2	6.15	93¾	+22 35
326	"	.....	υ	4.0	6.22	95½	+20 17
327	"	.....	γ	2.0	6.31	97¾	+16 31
328	"	.....	ϵ	3.2	6.36	99	+25 15
329	"	.....	ξ	3.4	6.38	99½	+13 2
330	"	.....	θ	3.7	6.45	101¼	+34 6
331	"	.....	ζ	4.0	6.57	104¼	+20 45
332	"	.....	λ	3.6	7.11	107¾	+16 45
333	"	.....	δ	3.6	7.13	108¼	+22 12
334	"	.....	ι	4.0	7.18	109½	+28 2
335	"	.....	ρ	4.2	7.21	110¼	+32 1
336	"	Castor	α	1.6	7.27	111¾	+32 9
337	"	.....	υ	4.2	7.28	112	+27 10
338	"	.....	σ	4.1	7.36	114	+29 10
339	"	.....	κ	3.6	7.37	114¼	+24 41
340	"	Pollux	β	1.1	7.38	114½	+28 19
341	Cancer	.....	β	3.8	8.10	122½	+ 9 33
342	"	.....	γ	4.8	8.36	129	+21 55
343	"	.....	δ	4.3	8.38	129½	+18 36
344	"	.....	ι	4.2	8.39	129¾	+29 12
345	"	.....	α	4.3	8.52	133	+12 19
346	Leo	.....	λ	4.4	9.25	141¼	+23 30
347	"	.....	o	3.8	9.34+	143¾	+10 26
348	"	.....	ϵ	3.1	9.39	144¾	+24 20
349	"	.....	μ	4.1	9.46	146½	+26 34
350	"	.....	η	3.6	10.1	150¼	+17 21
351	"	Regulus	α	1.4	10.2	150½	+12 33
352	"	.....	ζ	3.6	10.10	152½	+24 1
353	"	.....	γ	2.2	10.13	153¼	+20 27
354	"	.....	ρ	4.0	10.26	156½	+ 9 56
355	"	.....	Fl. 54	4.3	10.49	162¼	+25 23
356	"	.....	σ	4.5	10.56	164	+20 49
357	"	.....	δ	2.8	11.7	167	+21 11
358	"	.....	θ	3.5	11.8	167¼	+16 5
359	"	.....	ϕ	4.5	11.10	167½	+ 3 0
360	"	.....	σ	4.1	11.15	168¾	+ 6 41
361	"	.....	ι	4.0	11.17	169½	+11 12
362	"	.....	υ	4.5	11.30+	172¾	− 0 10
363	"	.....	Fl. 93	4.6	11.41+	175½	+20 53
364	"	Denebola	β	2.2	11.43	175¾	+15 15
365	Virgo	.....	ν	4.2	11.39	175	+ 7 12
366	"	.....	β	3.7	11.44	176	+ 2 27
367	"	.....	o	4.3	11.59	179¾	+ 9 24
368	"	.....	η	4.0	12.13+	183½	0 0
369	"	.....	γ	2.8	12.35	188¾	− 0 47
370	"	.....	δ	3.7	12.49	192¼	+ 4 3
371	"	Vinde-miatrix	ϵ	3.0	12.56	194	+11 36
372	"	.....	θ	4.4	13.3	196	− 4 54
373	"	Spica	α	1.2	13.19	199¾	−10 32
374	"	.....	ζ	3.5	13.28	202	+ 0 1
375	"	.....	τ	4.4	13.55	208¾	+ 2 7
376	"	.....	κ	4.3	14.6	211½	− 9 43
377	"	.....	ι	4.2	14.9	212¼	− 5 26
378	"	.....	μ	3.9	14.36	219¼	− 5 8
379	"	.....	Fl. 109	3.7	14.40	220	+ 2 24

STAR TABLES — *Continued*

No. in Sphere	Constellation	Name	Letter	Mag.	R. A. h. m.	R. A. Degrees	Decl'n °	′
380	Libra	.....	α	3.0	14.44	221¼	−15	32
381	"	.....	Fl. 16	4.5	14.51	222¾	− 3	51
382	"	.....	ι	4.9	15.5	226¼	−19	20
383	"	.....	β	2.7	15.10	227½	− 8	56
384	"	.....	γ	4.0	15.28+	232¼	−14	23
385	"	.....	Fl. 39	3.9	15.29	232½	−27	44
386	"	.....	Fl. 40	3.9	15.31	232¾	−29	23
387	"	.....	θ	4.3	15.47	236¾	−16	23
388	Scorpio	.....	ρ	4.0	15.49	237½	−28	52
389	"	.....	π	3.1	15.51	238	−25	46
390	"	.....	δ	2.5	15.53	238¼	−22	17
391	"	.....	ξ	4.1	15.57	239½	−11	12
392	"	.....	β^1	2.9	15.58	239¾	−19	29
393	"	.....	ω^1	4.1	15.59+	240	−29	21
394	"	.....	ν	4.2	16.5	241¼	−19	9
395	"	.....	σ	3.0	16.14	243½	−25	18
396	"	Antares	α	1.1	16.22	245½	−26	10
397	"	.....	τ	2.9	16.28	247	−27	58
398	"	.....	ϵ	2.2	16.42	250½	−34	5
399	"	.....	μ^1	3.6	16.43+	251	−37	50
400	"	.....	μ^2	3.9	16.44	251¼	−37	49
401	"	.....	ζ^2	3.6	16.46	251½	−42	9
402	"	.....	η	3.6	17.3	256	−43	5
403	"	.....	υ	2.8	17.22	260½	−37	12
404	"	.....	λ	1.7	17.25	261¼	−37	1
405	"	.....	θ	2.1	17.28	262¼	−42	55
406	"	.....	κ	2.6	17.34	263½	−38	58
407	"	.....	ι	3.3	17.39	264¾	−40	5
408	"	.....	G	3.0	17.46	266½	−37	1
409	Sagittarius	.....	4	4.6	17.52	268	−23	48
410	"	.....	γ^2	3.0	17.58	269½	−30	25
411	"	.....	μ	4.1	18.6	271½	−21	5
412	"	.....	η	3.0	18.9	272¼	−36	48
413	"	.....	δ	2.8	18.13	273¼	−29	53
414	"	.....	ϵ	2.1	18.16	274	−34	26
415	"	.....	λ	3.1	18.20	275	−25	29
416	"	.....	ϕ	3.3	18.38	279½	−27	7
417	"	.....	σ	2.3	18.47+	282¼	−26	27
418	"	.....	ξ^2	3.5	18.50	282½	−21	16
419	"	.....	ζ	2.9	18.55	283¾	−30	3
420	"	.....	o	3.9	18.57	284¼	−21	55
421	"	.....	τ	3.5	18.59	284½	−27	51
422	"	.....	π	3.1	19.2	285½	−21	13
423	"	.....	β^1	3.8	19.14	288½	−44	41
424	"	.....	β^2	4.4	19.14+	288½	−45	2
425	"	.....	ρ^1	3.9	19.14+	288¾	−18	4
426	"	.....	α	4.0	19.15	289	−40	51
427	"	.....	h^2	4.6	19.29	292¼	−25	9
428	"	.....	ι	4.3	19.47	296¾	−42	11
429	"	.....	σ	4.7	19.49	297¼	−27	29
430	"	.....	6843 BAC	4.2	19.52	298−	−35	36
431	Capricornus	.....	α	3.8	20.11	302¾	−12	55
432	"	.....	β	3.4	20.14	303½	−15	10

STAR TABLES — *Continued*

No. in Sphere	Constellation	Name	Letter	Mag.	R. A. h. m.	R. A. Degrees	Decl'n ° ′
433	Capricornus	.....	π	5.2	20.20	305	−18 36
434	"	.....	ψ	4.3	20.39	309¾	−25 42
435	"	.....	ω	4.4	20.44+	311	−27 22
436	"	.....	θ	4.3	20.59	314¾	−17 43
437	"	.....	A	4.6	21.0	315	−25 29
438	"	.....	ι	4.4	21.15	318¾	−17 21
439	"	.....	ζ	3.8	21.20	320	−22 56
440	"	.....	δ	4.5	21.21+	320½	−22 20
441	"	.....	ϵ	4.5	21.30	322½	−20 0
442	"	.....	γ	3.8	21.33	323¼	−17 12
443	Aquarius	.....	ϵ	3.8	20.41	310¼	− 9 56
444	"	.....	β	3.1	21.25	321¼	− 6 6
445	"	.....	α	3.2	21.59	329¾	− 0 54
446	"	.....	θ	4.3	22.10	332½	− 8 23
447	"	.....	γ	4.1	22.15	333¾	− 1 59
448	"	.....	ζ	3.8	22.22+	335¾	− 0 38
449	"	.....	η	4.2	22.29	337¼	− 0 44
450	"	.....	τ^2	4.1	22.43	340¾	−14 14
451	"	.....	δ	3.4	22.48	342	−16 28
452	"	.....	c^2	3.6	23.3	345¾	−21 49
453	"	.....	ϕ	4.2	23.8	347	− 6 41
454	"	.....	ψ^2	4.5	23.11	348	− 9 50
455	"	.....	ψ^3	5.1	23.12	348¼	−10 16
456	"	.....	δ^1	4.1	23.16	349¼	−20 45
457	"	.....	ω^2	4.7	23.36	354	−15 12
458	Pisces	.....	β	4.6	22.57+	344½	+ 3 10
459	"	.....	γ	3.8	23.11	347¾	+ 2 38
460	"	.....	κ	5.0	23.20	350¼	+ 0 36
461	"	.....	θ	4.4	23.22	350½	+ 5 43
462	"	.....	ι	4.3	23.33	353	+ 4 59
463	"	.....	λ	4.7	23.36	354	+ 1 7
464	"	.....	ω	4.2	23.53	358¼	+ 6 12
465	"	.....	δ	4.6	0.42	10½	+ 6 56
466	"	.....	ϵ	4.5	0.56	14¼	+ 7 15
467	"	.....	g	5.1	1.4	16¼	+30 47
468	"	.....	χ	4.9	1.5	16¼	+20 24
469	"	.....	τ	4.7	1.5	16½	+29 27
470	"	.....	ϕ	4.6	1.7	16¾	+23 56
471	"	.....	ζ	5.0	1.7	16¾	+ 6 57
472	"	.....	f	5.1	1.11	17¾	+ 2 59
473	"	.....	υ	4.7	1.13	18¼	+26 38
474	"	.....	μ	5.2	1.24	21	+ 5 31
475	"	.....	η	3.7	1.25	21¼	+14 44
476	"	.....	o	4.4	1.39	24¾	+ 8 33
477	"	.....	ξ	4.7	1.47	26¾	+ 2 36
478	"	.....	α	4.0	1.56	29	+ 2 11
479	Cetus	.....	ι	3.6	0.13	3¼	− 9 29
480	"	.....	β	2.1	0.37	9¼	−18 39
481	"	.....	η	3.6	1.2	15½	−10 49
482	"	.....	θ	3.8	1.18	19½	− 8 48
483	"	.....	τ	3.6	1.38	24½	−16 34
484	"	.....	ζ	3.8	1.45	26¼	−10 56
485	"	.....	ν	3.8	1.54	28½	−21 40
486	"	.....	ξ^1	4.4	2.6	31½	+ 8 17

STAR TABLES — *Continued*

No. in Sphere	Constellation	Name	Letter	Mag.	R. A. h. m.	R. A. Degrees	Decl'n ° ′
487	Cetus	Mira	o	1.7 to 5	2.13	33¼	− 3 31
488	"	.....	ξ^2	4.4	2.21+	35½	+ 7 56
489	"	.....	γ	3.6	2.37	39¼	+ 2 44
490	"	.....	π	4.3	2.38	39½	−14 22
491	"	.....	μ	4.4	2.38	39½	+ 9 36
492	"	Menkar	α	2.7	2.56	44	+ 3 37
493	Orion	.....	π^1	3.3	4.43	70¾	+ 6 45
494	"	.....	π^2	4.4	4.44	71	+ 8 42
495	"	.....	π^3	4.0	4.45	71¼	+ 5 24
496	"	.....	π^5	3.9	4.48	72	+ 2 15
497	"	.....	π^4	4.8	4.48+	72	+ 9 59
498	"	Rigel	β	0.3	5.9	77¼	− 8 20
499	"	.....	τ	3.6	5.12	78	− 6 59
500	"	.....	o	4.6	5.15+	78¾	− 0 30
501	"	.....	e	4.3	5.18	79½	− 7 55
502	"	.....	η	3.5	5.18+	79½	− 2 31
503	"	.....	γ	1.9	5.18+	79½	+ 6 14
504	"	.....	Fl. A	4.3	5.24	81	+ 5 51
505	"	.....	δ	2.4	5.26	81½	− 0 23
506	"	.....	ϕ^1	4.4	5.28	82	+ 9 24
507	"	.....	λ	3.5	5.28+	82	+ 9 51
508	"	.....	θ^1	4.4	5.29	82¼	− 5 28
509	"	.....	ι	3.0	5.29+	82¼	− 5 59
510	"	.....	ϵ	1.8	5.30	82½	− 1 17
511	"	.....	ϕ^2	4.4	5.30	82½	+ 9 13
512	"	.....	σ	3.7	5.32+	83	− 2 40
513	"	.....	ζ	1.9	5.34+	83½	− 2 0
514	"	.....	κ	2.2	5.42	85½	− 9 43
515	"	Betelgeuze	α	0.9	5.48+	87	+ 7 23
516	"	.....	μ	4.3	5.56	89	+ 9 39
517	"	.....	ξ	4.2	6.5	91¼	+14 14
518	Eridanus	.....	ι	4.2	2.36	39	−40 22
519	"	.....	τ^1	4.7	2.39	39¾	−19 5
520	"	.....	τ^2	4.8	2.45	41¼	−21 30
521	"	.....	η	4.0	2.50	42½	− 9 23
522	"	.....	θ	2.6	2.55	43½	−40 47
523	"	.....	τ^3	4.1	2.57	44¼	−24 6
524	"	.....	12	3.8	3.7	46¾	−29 28
525	"	.....	τ^4	3.8	3.14	48½	−22 12
526	"	.....	e	4.4	3.15	48¾	−43 32
527	"	.....	ϵ	3.7	3.27	51¾	− 9 52
528	"	.....	τ^5	4.2	3.28	52	−22 2
529	"	.....	y	4.8	3.32+	53¼	−40 40
530	"	.....	δ	3.7	3.37	54¼	−10 10
531	"	.....	υ	4.8	3.38	54½	−37 41
532	"	.....	π	4.4	3.40	55	−12 29
533	"	.....	τ^6	4.3	3.41	55¼	−23 36
534	"	.....	υ^2	4.1	3.45	56¼	−36 34
535	"	.....	γ	3.0	3.52	58	−13 51
536	"	.....	o^1	4.1	4.6	61½	− 7 9
537	"	.....	o^2	4.5	4.9	62½	− 7 50
538	"	.....	υ^4	3.3	4.13	63¼	−34 6
539	"	.....	υ^6	4.4	4.28+	67¼	−30 1
540	"	.....	υ	4.1	4.30	67½	− 3 36

STAR TABLES — *Continued*

No. in Sphere	Constellation	Name	Letter	Mag.	R. A. h. m.	R. A. Degrees	Decl'n ° ′
541	Eridanus	.....	v^7	3.8	4.31	67¾	−30 49
542	"	.....	μ	4.3	4.39	69¾	− 3 29
543	"	.....	ω	4.2	4.47	71¾	− 5 39
544	"	.....	β	2.9	5.2	75½	− 5 15
545	"	.....	λ	4.4	5.3	75¾	− 8 55
546	Lepus	.....	ϵ	3.3	5.0	75	−22 32
547	"	.....	μ	3.3	5.7	76¾	−16 21
548	"	.....	κ	4.6	5.7	76¾	−13 5
549	"	.....	λ	4.3	5.14	78½	−13 18
550	"	.....	β	3.0	5.23	80¾	−20 51
551	"	.....	α	2.7	5.27	81¾	−17 55
552	"	.....	γ	3.8	5.39	84¾	−22 29
553	"	.....	ζ	3.7	5.41	85¼	−14 51
554	"	.....	δ	4.0	5.46	86½	−20 53
555	"	.....	η	3.7	5.51	87¾	−14 11
556	"	.....	θ	4.6	6.0	90¼	−14 55
557	Canis Major	.....	ζ	3.0	6.15	94	−30 1
558	"	.....	β	2.0	6.17	94½	−17 54
559	"	.....	3	4.1	6.17	94¾	−33 22
560	"	.....	λ	4.1	6.23	96	−32 30
561	"	.....	ξ^1	4.2	6.27	96¾	−23 19
562	"	.....	ν^2	4.2	6.31	98	−19 9
563	"	Sirius	α	−1.4	6.40	100	−16 33
564	"	.....	κ	3.9	6.45	101¼	−32 22
565	"	.....	θ	4.2	6.48	102	−11 53
566	"	.....	o^1	4.0	6.49	102¼	−24 2
567	"	.....	ι	4.5	6.50+	102¾	−16 54
568	"	.....	ϵ	1.5	6.54	103½	−28 48
569	"	.....	Fl. 22	3.5	6.57	104¼	−27 46
570	"	.....	o^2	3.0	6.58	104½	−23 40
571	"	.....	γ	4.1	6.58	104¾	−15 27
572	"	.....	δ	1.8	7.3	106	−26 12
573	"	.....	Fl. 28	3.7	7.10	107½	−26 34
574	"	.....	Fl. 30	4.3	7.13	108½	−24 44
575	"	.....	η	2.4	7.19	109¾	−29 4
576	Canis Minor	.....	ϵ	5.0	7.19	109¾	+ 9 31
577	"	.....	β	3.1	7.20	110	+ 8 32
578	"	.....	γ	4.6	7.21	110¼	+ 9 10
579	"	.....	δ	5.1	7.26	111½	+ 2 10
580	"	Procyon	α	0.5	7.33	113¼	+ 5 32
581	"	.....	Fl. 13	4.9	7.56	119	+ 2 40
582	Argo (Puppis)	.....	π	2.7	7.13	108¼	−36 53
583	"	.....	σ	3.5	7.25	111	−43 4
584	"	.....	Fl. 3	4.2	7.39	114¾	−28 40
585	"	.....	c	3.6	7.41	115¼	−37 41
586	"	.....	ξ	3.4	7.44	116	−24 34
587	"	.....	ζ	2.5	7.59	119¾	−39 40
588	"	.....	ρ (1)	2.9	8.2	120½	−23 58
589	"	.....	Fl. 16	4.2	8.3	120¾	−18 54
590	"	.....	h^1	4.8	8.7	121¾	−39 15
591	"	.....	h^2	4.8	8.9+	122½	−39 59
592	Argo (Vela)	.....	e	4.6	8.33	128¼	−42 34
593	Argo (Malus)	.....	b	4.4	8.35	128¾	−34 53
594	"	.....	α	3.6	8.39	129¾	−32 45

STAR TABLES — *Continued*

No. in Sphere	Constellation	Name	Letter	Mag.	R. A. h. m.	R. A. Degrees	Decl'n ° ′
595	Argo (Vela)	.....	d	4.4	8.40	130	−42 13
596	"	.....	α	4.1	8.42	130½	−45 36
597	Argo (Malus)	.....	c	4.3	8.45	131¼	−27 16
598	Argo (Vela)	.....	B A C 3081	5.2	8.55	134	−40 47
599	"	.....	λ	2.5	9.3	136	−42 57
600	"	.....	ψ	3.7	9.26	141½	−39 57
601	"	.....	m	4.8	9.47	146¾	−45 59
602	Hydra	.....	δ	4.1	8.31	127¾	+ 6 7
603	"	.....	σ	4.4	8.32	128	+ 3 46
604	"	.....	η	4.2	8.37	129¼	+ 3 50
605	"	.....	ε	3.6	8.40	130	+ 6 52
606	"	.....	ρ	4.3	8.42	130½	+ 6 17
607	"	.....	ζ	3.3	8.49	132¼	+ 6 24
608	"	.....	θ	3.9	9.8	137	+ 2 49
609	"	.....	α	2.0	9.21	140½	− 8 8
610	"	.....	ι	4.2	9.34	143½	− 0 36
611	"	.....	λ	3.9	10.4	151¼	−11 46
612	"	.....	μ	4.1	10.20	155	−16 13
613	"	.....	ν	3.3	10.43	161	−15 34
614	"	.....	β	4.0	11.45	176¼	−33 0
615	"	.....	γ	3.4	13.12	198	−22 32
616	"	.....	R	3.5	13.24	211	−22 46
617	"	.....	π	3.5	13.59	210	−26 6
618	"	.....	Fl. 51	4.9	14.16	214	−27 12
619	Crater	.....	α	4.1	10.54	163½	−17 40
620	"	.....	β	4.4	11.5+	166½	−22 10
621	"	.....	η	5.0	11.10	167½	−16 29
622	"	.....	δ	3.9	11.15	168¼	−14 8
623	"	.....	λ	5.0	11.17	169¼	−18 7
624	"	.....	ε	5.0	11.18	169½	−10 12
625	"	.....	γ	4.2	11.19	169¾	−17 1
626	"	.....	θ	4.7	11.30	172½	− 9 8
627	"	.....	ζ	4.9	11.38	174½	−17 41
628	Corvus	.....	α	4.3	12.2	180½	−24 3
629	"	.....	ε	3.1	12.4	181	−21 57
630	"	.....	γ	2.8	12.9	182¼	−16 53
631	"	.....	δ	3.1	12.23	186	−15 51
632	"	.....	η	4.4	12.26	186½	−15 32
633	"	.....	β	2.8	12.28	187	−22 44
634	Centaurus	.....	4321 B A C	4.4	12.46+	191¾	−39 32
635	"	.....	ι	3.0	13.14	198½	−36 5
636	"	.....	4507 B A C	4.5	13.24	201	−38 47
637	"	.....	i	4.5	13.39	204¾	−32 26
638	"	.....	ν	3.7	13.42	205½	−41 5
639	"	.....	μ	3.4	13.42	205¾	−41 53
640	"	.....	g	4.6	13.42	205¾	−33 51
641	"	.....	κ	4.7	13.45	206¼	−32 24
642	"	.....	ζ	2.7	13.48	207	−46 42
643	"	.....	ν^1	4.2	13.51	207¾	−44 13
644	"	.....	θ	1.7	13.59	210	−35 47
645	"	.....	ψ	4.4	14.13	213¼	−37 20
646	"	.....	η	2.5	14.28	217	−41 38

STAR TABLES — *Continued*

No. in Sphere	Constellation	Name	Letter	Mag.	R. A. h. m.	R. A. Degrees	Decl'n °	′
647	Centaurus	.....	4842 B A C	4.2	14.34	218½	−37	16
648	"	.....	4852 B A C	4.3	14.36	219	−34	39
649	"	.....	κ	3.3	14.51	222¾	−41	37
650	Lupus	.....	α	2.6	14.34	218½	−46	52
651	"	.....	β	2.8	14.50	222¾	−42	39
652	"	.....	λ	4.8	15.8	225¼	−44	49
653	"	.....	2	4.7	15.0	227½	−29	42
654	"	.....	f	*4.00	15.13	228¼	−29	30
655	"	.....	δ	3.7	15.13	228¼	−40	13
656	"	.....	ϕ^1	3.6	15.14	228½	−35	50
657	"	.....	ε	3.7	15.14	228¾	−44	16
658	"	.....	γ	3.2	15.27	231¾	−40	46
659	"	.....	ι	4.7	15.30	232½	−42	10
660	"	.....	ψ^1	4.6	15.32	233	−34	1
661	"	.....	χ	4.0	15.43	235¾	−33	16
662	"	.....	ξ	4.5	15.49	237¼	−33	37
663	"	.....	η	3.7	15.52	238	−38	3
664	"	.....	θ	4.9	15.58	239½	−36	28
665	Corona Australis	.....	γ	4.6	18.58	284½	−37	14
666	"	.....	α	4.2	19.1	285¼	−38	5
667	"	.....	β	4.1	19.2	285½	−39	32
668	Piscis Australis	.....	Fl. 4	4.8	21.10	317¾	−32	40
669	"	.....	ι	4.2	21.37+	324½	−33	34
670	"	.....	μ	4.5	22.1	330¼	−33	34
671	"	.....	β	4.3	22.24	336¼	−32	58
672	"	.....	ε	4.1	22.34	338½	−27	40
673	"	.....	γ	4.3	22.46	341½	−33	31
674	"	.....	δ	4.4	22.49	342¼	−33	11
675	"	Fomalhaut	α	1.3	22.51	342¾	−30	16
676	Sculptor	.....	γ	4.6	23.12	348	−33	11
677	"	.....	δ	4.6	23.42	355½	−28	48
678	"	.....	α	4.1	0.53	13¼	−30	0
679	Phoenix	.....	κ	3.9	0.20	5	−44	21
680	"	.....	α	2.4	0.20	5	−42	58
681	"	.....	γ	3.4	1.23	20¾	−43	56
682	Fornax	.....	643 B A C	4.6	1.59	29¾	−29	52
683	"	.....	β	4.7	2.44	41	−32	55
684	Columba	.....	ε	3.8	5.27	81¾	−35	34
685	"	.....	α	2.7	5.35	83¾	−34	8
686	"	.....	β	2.9	5.46	86½	−35	48
687	"	.....	γ	4.1	5.53	88¼	−35	17
688	Monoceros	.....	Fl. 5	4.0	6.4	92¼	− 6	15
689	"	.....	Fl. 11	3.9	6.23	95¾	− 6	57
690	"	.....	Fl. 13	4.3	6.26	96½	+ 7	26
691	"	.....	γ	4.2	7.35	113¾	− 9	16
692	"	.....	Fl. 30	3.9	8.19	124¾	− 3	31

*About.

STARS OF THE FIRST MAGNITUDE (OR BRIGHTER)

No. in Sphere	Constellation	Name	Letter	Mag.	R. A. h. m.	R. A. Degrees	Decl'n °	′
563	Canis Major	Sirius	α	−1.4	6.40	100	−16	33
183	Auriga	Capella	α	0.2	5.7	77	+45	52
498	Orion	Rigel	β	0.3	5.9	77¼	− 8	20
580	Canis Minor	Procyon	α	0.5	7.33	113¼	+ 5	32
74	Bootes	Arcturus	α	0.0	14.10	212½	+19	48
121	Lyra	Vega	α	0.2	18.33	278¼	+38	40
320	Taurus	Aldebaran	α	1.0	4.29	67¼	+16	16
515	Orion	Betelgeuze	α	0.9	5.48+	87	+ 7	23
340	Gemini	Pollux	β	1.1	7.38	114½	+28	19
351	Leo	Regulus	α	1.4	10.2	150½	+12	33
373	Virgo	Spica	α	1.2	13.19	199¾	−10	32
396	Scorpio	Antares	α	1.1	16.22	245½	−26	10
234	Aquila	Altair	α	1.0	19.45	296¼	+ 8	33
141	Cygnus	Deneb	α	1.5	20.37	309¼	+44	51
675	Piscis Australis	Fomalhaut	α	1.3	22.51	342¾	−30	16

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